

Patent claims

1. Method for switching a semi-conductor circuit breaker (S1, S2),

characterized in that

5 the resistance of the breaker gap of the semi-conductor circuit breaker (S1, S2) is controlled by a control voltage V_{st} to such an extent that the power loss P_{ist} from the circuit breaker (S1, S2) does not exceed a predetermined setpoint P_{soll} .

10 2. Method according to claim 1, characterized in that for determining the power loss P_{ist} from the circuit breaker (S1, S2), from the differential voltage V_{diff} between the connections (S1, S2), the absolute value $V_{diffabs}$ of this differential voltage V_{diff} is formed referred to the reference

15 potential GND,

the differential $d(V_{diffabs})/dt$ in time of this differential voltage V_{diff} is formed,

according to the formula

$$P_{ist} = V_s \cdot I_s = V_{diffabs} \cdot d(V_{diffabs})/dt \cdot C_1,$$

20 with V_s = switch voltage $V_{diffabs}$,

$$I_s = d(V_{diffabs})/dt \cdot C_1,$$

$$C_1 = \text{const},$$

the differential $d(V_{diffabs})/dt$ in time is multiplied by the absolute value $V_{diffabs}$ and a constant value C_1 , in which case

25 the product of the circuit breaker (S1, S2) corresponds to the power loss P_{ist} , and

the power loss P_{ist} is regulated to a predetermined setpoint P_{soll} , in which case the controlled variable serves as the control signal E_n for generating the control voltage V_{st} .

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3. Method according to claim 1, characterized in that

from the differential voltage V_{diff} between the connections of the circuit breaker (S1, S2), the absolute value $V_{diffabs}$ of this differential voltage V_{diff} is formed referred to the

5 reference potential,

from the known or measurable system variables such as capacity C_1 , differential voltage $V_{diffabs}$ and the power of the switch P_{soll} , a time-variable nominal voltage $V_{soll}(t)$ allocated to a constant power of the switch P_{soll} can be determined and

10 stored for the process of reversing the charge, and

this nominal voltage $V_{soll}(t)$ is used as the command variable for regulating the differential voltage $V_{diffabs}$ for the process of reversing the charge starting with the differential voltage $V_{diffabs}$ at the start (t_0) of the process of reversing

15 the charge up to the point in time t_1 when the process of reversing the charge has ended and $V_{diffabs} = 0V$, in which case the controlled variable serves as the control signal (E_n) for generating the control voltage V_{st} .

4. Device for implementing said method according to one of the
20 claims 1 to 3 for actuating a circuit breaker (S1, S2), in particular a semi-conductor circuit breaker (S1, S2) arranged between two energy storage devices (C_1 , DLC, B36) in a wiring system of the vehicle equipped with an integrated starter generator(ISG),

25 characterized in that

the circuit breaker (S1, S2) is embodied as a transfer gate (TG) with two semi-conductors (Q_1 , Q_2) connected in series of which, in the off-state of the circuit breaker (S1, S2), at least one of them is blocked, and

30 for generating the control voltage V_{st} , a charge pump (LP) is provided by means of which the semi-conductors (Q_1 , Q_2) of the circuit breaker (S1, S2), in the conductive state, are in each case only controlled to such an extent that the power loss P_{ist} from the circuit breaker (S1, S2) does not exceed a

predetermined setpoint P_{soll} .

5. Device according to claim 4, characterized in that a transistor (Q3) is provided in the transfer gate (TG), the collector emitter route of said transistor being arranged
5 between the interconnected gate connections (g) and the interconnected source connections (s) of two semi-conductors (Q1, Q2) connected in series which can be shifted by means of an external signal (Dis) to the conductive state in order to control the transfer gate (TG) quickly in a non-conductive
10 manner.

6. Device according to claim 4, characterized in that for determining the power loss P_{ist} from the circuit breaker (S1, S2),

- a voltage transmitter (GV) is provided which from the
15 differential voltage V_{diff} between the connections (A, E) of the circuit breaker (S1, S2) forms the absolute value $V_{diffabs}$ of this differential voltage V_{diff} referred to the reference potential GND,

- a differentiator (A3, d/dt) is provided in which the
20 differential $d(V_{diffabs})/dt$ in time is formed, and

- a multiplier (M) is provided which multiplies the differential $d(V_{diffabs})/dt$ in time by the absolute value $V_{diffabs}$ and a constant value C1 and whose output signal conforms to the power loss P_{ist} from the circuit breaker (S1, S2).
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7. Device according to claim 4, characterized in that a microcontroller (μC) is provided in which the power loss P_{ist} is determined digitally,
with an A/D converter (A/D) which continuously digitalizes the
30 output signal $V_{diffabs}$ of the differential amplifier (A2),
with an intermediate storage device (ZS) in which the digitalized signal $V_{diffabs}$ is stored,
with a digital differentiator (d/dt) which differentiates the

stored signal $V_{diffabs}$ to $d(V_{diffabs})/dt$,
with a digital multiplier (x) which multiplies the digital
signal $V_{diffabs}$ by the differential $d(V_{diffabs})/dt$ and a
constant $C1$ to a value corresponding to a power loss P_{ist} from
5 the circuit breaker ($S1$, $S2$), and
with a D/A converter (D/A) which converts this digital value
to an analog value P_{ist} .

8. Device according to claim 4 or 6, characterized in that a
controller ($K2$) is provided which regulates the power loss
10 P_{ist} to a predetermined setpoint P_{soll} , and whose output
signal, the controlled variable is supplied as a control
signal E_n to the charge pump (LP) to generate the control
voltage V_{st} .

9. Device according to claim 8, characterized in that the
15 controller ($K2$) is a two-state controller.

10. Device according to claim 4, characterized in that a
voltage transmitter (GV) is provided which from the
differential voltage V_{diff} between the connections (A, E) of
the circuit breaker ($S1$, $S2$) forms the absolute value $V_{diffabs}$
20 of this differential voltage V_{diff} referred to the reference
potential,

a microcontroller (μC) is provided to which the differential
voltage $V_{diffabs}$ is supplied in which the time-variable
nominal voltage $V_{soll}(t)$ is stored in a table (T), and

25 a controller ($K2$) is provided to which the differential
voltage $V_{diffabs}$ is supplied to its inverting input and the
time-variable nominal voltage $V_{soll}(t)$ to its non-inverting
input, and whose output signal, the controlled variable is
supplied as a control signal E_n to the charge pump (LP) to
30 generate the control voltage V_{st} .